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Large-scale Natural Hazard Risks

Large-scale natural hazard risks refer to potential catastrophic events that result from natural processes, such as earthquakes, tsunamis, hurricanes, floods, droughts, wildfires, volcanic eruptions, and pandemics. These events have the potential to cause significant damage to infrastructure, disrupt economies, lead to loss of life and livelihoods, and have long-lasting social and environmental impacts.

Types of Natural Hazards:

- a. **Earthquakes:** Sudden shaking of the Earth's surface caused by the release of energy in the Earth's crust, resulting in ground shaking, tsunamis, landslides, and infrastructure damage.
- b. **Tsunamis:** Large sea waves triggered by undersea earthquakes, volcanic eruptions, or landslides, causing coastal flooding and destruction.
- c. **Hurricanes and Cyclones:** Intense tropical storms with strong winds and heavy rainfall, leading to storm surge, flooding, and widespread damage.
- d. **Floods:** Overflow of water onto normally dry land, caused by heavy rainfall, snowmelt, or dam failure, resulting in property damage, displacement, and loss of life.
- e. **Droughts:** Prolonged periods of abnormally low rainfall, leading to water scarcity, crop failure, food insecurity, and ecosystem degradation.
- f. **Wildfires:** Uncontrolled fires that spread rapidly across vegetation, causing destruction of forests, habitats, and property.
- g. **Volcanic Eruptions:** Explosive release of magma, ash, and gases from volcanoes, leading to ash fall, pyroclastic flows, lahars, and air pollution.

h. Pandemics: Global outbreaks of infectious diseases, such as COVID-19, with widespread impacts on public health, economies, and societal functioning.

Negative Effects of Large-Scale Natural Hazard Risks:

a. Loss of Life and Injuries: Natural hazards can result in the loss of human lives and cause injuries, leading to immense personal and societal suffering.

b. Infrastructure Damage: Buildings, roads, bridges, power lines, and other critical infrastructure can be severely damaged or destroyed, disrupting essential services and economic activities.

c. Economic Impact: Natural hazards can lead to significant economic losses, including the destruction of property, loss of livelihoods, decreased productivity, increased unemployment, and increased government expenditure on relief and recovery efforts.

d. Environmental Degradation: Large-scale natural hazards can cause environmental damage, such as deforestation, soil erosion, habitat destruction, and contamination of water bodies, affecting ecosystems and biodiversity.

e. Displacement and Migration: Natural hazard events often result in the displacement of populations, as people are forced to flee their homes due to the destruction and unlivable conditions. This can lead to internal and cross-border migration, straining resources and increasing social tensions.

f. Social and Psychological Impacts: Natural hazards can have profound social and psychological effects on affected communities, leading to trauma, stress, and long-term mental health challenges.

g. Social Inequalities: Natural hazards often disproportionately affect vulnerable populations, exacerbating existing social inequalities and disparities in access to resources, healthcare, and recovery support.

h. Interconnected Risks: Large-scale natural hazards can trigger secondary hazards or exacerbate existing vulnerabilities, creating cascading effects and increasing the complexity of response and recovery efforts.

Global Risks in the Future:

a. Climate Change Amplification: Climate change is expected to increase the frequency and intensity of many natural hazards, amplifying their negative impacts and expanding the areas at risk.

b. Urbanization and Population Growth: Rapid urbanization and population growth in hazard-prone areas increase exposure to natural hazards, potentially leading to more significant impacts and challenges in managing and responding to disasters.

c. Fragile Ecosystems and Biodiversity Loss: The degradation of ecosystems and loss of biodiversity reduce natural buffers and resilience against natural hazards, making ecosystems and human populations more vulnerable to their impacts.

d. Interconnected Systems: The interconnectedness of global systems, such as transportation, communication, and supply chains, can create cascading effects when natural hazards disrupt these systems, leading to widespread economic and societal disruptions beyond the local level.

e. Pandemic Risks: The experience of the COVID-19 pandemic highlights the global risks associated with infectious diseases. Future pandemics could have severe health, economic, and social consequences, demanding robust preparedness and response measures.

f. Technological Dependencies: Increasing reliance on complex technological systems, such as power grids, telecommunications

networks, and digital infrastructure, can make societies more vulnerable to natural hazards if these systems fail or are damaged.

g. **Governance and Preparedness:** The ability of governments and institutions to effectively govern, prepare for, and respond to large-scale natural hazards varies globally. Weak governance, inadequate infrastructure, and limited preparedness can exacerbate the impacts of natural hazards, particularly in developing regions.

Risk Reduction and Resilience:

a. **Disaster Risk Reduction (DRR):** DRR aims to minimize the impacts of natural hazards through proactive measures, including risk assessment, early warning systems, land-use planning, infrastructure resilience, and community preparedness.

b. **Resilience Building:** Building resilience involves enhancing the capacity of individuals, communities, and systems to withstand, adapt to, and recover from natural hazards. This includes strengthening social networks, improving infrastructure design, promoting sustainable practices, and ensuring access to essential services.

c. **Climate Change Adaptation:** Given the link between climate change and natural hazards, climate change adaptation strategies are crucial in reducing future risks. This involves implementing measures to adapt to changing climatic conditions, such as sea-level rise, increased temperatures, and altered precipitation patterns.

International Cooperation and Frameworks:

a. **Sendai Framework for Disaster Risk Reduction:** The Sendai Framework, adopted by the UN in 2015, provides a global roadmap for DRR. It aims to reduce disaster risk, enhance resilience, and strengthen international cooperation to address natural hazards effectively.

b. International Collaboration: International organizations, such as the UN Office for Disaster Risk Reduction (UNDRR), coordinate efforts among countries, provide technical assistance, and facilitate knowledge sharing to improve global resilience to natural hazards.

c. Regional Initiatives: Regional cooperation and initiatives play a crucial role in addressing large-scale natural hazard risks. Regional bodies, such as the European Union's Civil Protection Mechanism, facilitate collaboration, resource sharing, and joint response efforts in the face of natural hazards.

Technological Advancements:

a. Early Warning Systems: Advances in technology have led to the development of more sophisticated early warning systems for natural hazards. These systems use real-time data, satellite imagery, modeling, and communication networks to provide timely alerts, enabling communities to take preventive actions.

b. Remote Sensing and GIS: Remote sensing techniques, such as satellite imagery and aerial surveys, coupled with Geographic Information Systems (GIS), aid in hazard mapping, risk assessment, and monitoring. This information helps in understanding hazard-prone areas and guiding land-use planning and emergency response.

c. Data Analytics and Artificial Intelligence: Data analytics and artificial intelligence (AI) play a crucial role in analyzing large datasets, identifying patterns, and predicting natural hazard risks. These technologies can enhance early warning systems, improve risk assessment models, and support decision-making processes.

Community Engagement and Education:

a. Community-Based Approaches: Engaging local communities in disaster risk reduction efforts is essential. Community-based approaches involve empowering communities to understand,

communicate, and respond to natural hazards effectively. This includes participatory planning, training programs, and public awareness campaigns.

b. **Education and Awareness:** Education plays a vital role in building a culture of resilience. Promoting hazard awareness, teaching preparedness skills, and integrating DRR into school curricula can contribute to long-term risk reduction and behavior change.

Financing and Insurance:

a. **Disaster Risk Financing:** Governments and international financial institutions are exploring innovative financing mechanisms to cover the costs of response, recovery, and reconstruction following natural hazards. This includes contingency funds, insurance schemes, and public-private partnerships.

b. **Climate and Catastrophe Insurance:** Insurance products, such as climate and catastrophe insurance, can help individuals, businesses, and governments manage and transfer the financial risks associated with natural hazards. These insurance schemes provide financial resources for recovery and rebuilding efforts.

Ethical Considerations:

a. **Equity and Social Justice:** Addressing large-scale natural hazard risks requires a focus on equity and social justice. Ensuring that vulnerable populations, marginalized communities, and those disproportionately affected by hazards have equal access to resources, services, and decision-making processes is crucial.

b. **Indigenous Knowledge and Practices:** Recognizing and integrating indigenous knowledge and practices can contribute to more effective risk reduction strategies.

Indigenous communities often possess valuable traditional knowledge and practices that have helped them adapt to and cope with natural hazards for generations.

Future Challenges and Emerging Risks:

a. **Urbanization and Informal Settlements:** Rapid urbanization and the growth of informal settlements in hazard-prone areas increase the vulnerability of populations to natural hazards, requiring effective urban planning, infrastructure development, and social protection measures.

b. **Climate Change-Induced Migration:** Climate change impacts, including natural hazards, can lead to increased migration and displacement. Adequate policies and frameworks are needed to address the challenges associated with climate-induced migration.

c. **Emerging Infectious Diseases:** The risk of emerging infectious diseases, similar to the COVID-19 pandemic, poses ongoing threats to global health security. Preparedness, surveillance systems, and international collaboration are vital to mitigate the impacts of future pandemics.

Governments and policies play a crucial role in the emergence and management of large-scale natural hazard risks. Their actions and decisions can either contribute to exacerbating or mitigating these risks.

Risk Assessment and Planning:

a. **Hazard Mapping and Zoning:** Governments are responsible for conducting risk assessments, including hazard mapping, to identify areas prone to natural hazards. Based on these assessments, they can develop zoning regulations and land-use plans to restrict or control development in high-risk areas.

b. Building Codes and Regulations: Governments establish and enforce building codes and regulations to ensure that structures are designed and constructed to withstand potential natural hazards. These codes specify standards for seismic resistance, wind resistance, flood resilience, and other relevant considerations.

c. Infrastructure Planning: Governments are responsible for planning and developing critical infrastructure, such as roads, bridges, dams, and power grids, with considerations for natural hazard risks. Proper design, construction, and maintenance of infrastructure can reduce vulnerability and increase resilience.

Early Warning Systems and Preparedness:

a. Early Warning Systems: Governments are responsible for establishing and maintaining early warning systems that can detect and communicate impending natural hazards. This includes investing in monitoring networks, data collection, analysis, and dissemination of timely alerts to at-risk communities.

b. Emergency Response Planning: Governments develop emergency response plans and protocols to ensure a coordinated and effective response to natural hazards. These plans involve various stakeholders, including emergency services, health agencies, and community organizations, and outline actions for evacuation, search and rescue, medical assistance, and provision of essential supplies.

c. Public Awareness and Education: Governments play a vital role in raising public awareness about natural hazards, their risks, and the necessary preparedness measures. They engage in public education campaigns, disseminate information through various media channels, and provide resources to help individuals and communities understand and respond to hazards.

Risk Reduction and Mitigation:

a. **Disaster Risk Reduction (DRR) Policies:** Governments formulate and implement DRR policies that aim to reduce the underlying risk factors associated with natural hazards. These policies promote measures such as ecosystem protection, climate change adaptation, infrastructure resilience, and community-based initiatives.

b. **Land-Use Planning and Environmental Protection:** Governments establish regulations and policies related to land-use planning and environmental protection to minimize exposure to natural hazards. This includes protecting wetlands, forests, and coastal areas, and promoting sustainable development practices that consider hazard risks.

c. **Climate Change Adaptation:** Governments develop strategies and policies to address the impacts of climate change, which are closely linked to natural hazards. This involves mitigating greenhouse gas emissions, promoting renewable energy sources, and implementing adaptation measures to reduce vulnerability to changing climatic conditions.

Governance and Institutional Capacity:

a. **National Disaster Management Agencies:** Governments establish national disaster management agencies or departments responsible for coordinating and implementing policies and programs related to natural hazards. These agencies often work in collaboration with other government ministries, local authorities, and international organizations.

b. **Legislation and Regulations:** Governments enact legislation and regulations to provide a legal framework for managing natural hazard risks. These laws may cover areas such as environmental protection, building codes, emergency management, and financial mechanisms for disaster recovery.

c. International Cooperation: Governments engage in international cooperation and collaboration to address transboundary natural hazard risks. This includes sharing information, expertise, and resources, and participating in regional and global frameworks, such as the Sendai Framework for Disaster Risk Reduction.

Funding and Resource Allocation:

a. Budget Allocation: Governments allocate budgets for disaster risk reduction, preparedness, response, and recovery. Sufficient funding is necessary to implement policies, maintain infrastructure, support research and development, and provide financial assistance to affected communities.

b. Insurance and Risk Financing: Governments may establish insurance schemes, risk pools, or financial mechanisms to provide coverage for natural hazards. These mechanisms can help transfer risks and provide financial resources for recovery and reconstruction.

c. International Aid and Assistance: Governments seek international aid and assistance during and after large-scale natural hazard events. They collaborate with international organizations, donor countries, and non-governmental organizations to secure financial resources, expertise, and technical support for response and recovery efforts.

The United Nations (UN) and affiliated non-governmental organizations (NGOs) play a vital role in identifying and preventing large-scale natural hazard risks.

Risk Assessment and Monitoring:

a. Global Assessment Reports: The UN, through its specialized agencies and programs, conducts global assessments and reports on various aspects of natural hazards, including their impacts, vulnerabilities, and risk factors. These reports provide valuable

insights and data for identifying and understanding large-scale natural hazard risks.

b. Data Collection and Analysis: The UN supports efforts to collect, analyze, and disseminate data related to natural hazards. This includes the establishment of global databases, development of standardized methodologies, and coordination of data sharing among member states and relevant stakeholders.

c. Scientific Research and Knowledge Sharing: The UN promotes scientific research on natural hazards and facilitates the exchange of knowledge and best practices. It supports collaboration between scientists, policymakers, and practitioners to enhance understanding, improve risk assessment methodologies, and develop innovative solutions.

Policy Development and Advocacy:

a. International Frameworks: The UN develops and promotes international frameworks and agreements to address natural hazards and disaster risk reduction. For example, the Sendai Framework for Disaster Risk Reduction provides a global roadmap for reducing risks and enhancing resilience.

b. Policy Guidance: The UN provides policy guidance to member states on strategies, best practices, and policy frameworks for preventing and managing natural hazard risks. This includes recommendations on land-use planning, infrastructure development, early warning systems, and climate change adaptation.

c. Advocacy and Awareness: The UN raises awareness about the importance of addressing natural hazard risks and advocates for policy action at various levels. It engages in public campaigns, high-level meetings, and international conferences to promote understanding, mobilize resources, and foster political commitment.

Capacity Building and Technical Assistance:

a. Training Programs: The UN and its affiliated NGOs offer training programs and capacity-building initiatives to enhance the technical skills and knowledge of government officials, practitioners, and communities in identifying and preventing natural hazard risks. These programs cover areas such as risk assessment, early warning systems, disaster management, and climate change adaptation.

b. Technical Assistance: The UN provides technical assistance to member states in developing and implementing strategies for identifying and preventing natural hazard risks. This includes support in risk assessment methodologies, early warning system development, land-use planning, and policy implementation.

c. Knowledge Exchange Platforms: The UN facilitates knowledge exchange platforms, workshops, and networks where member states, NGOs, and civil society organizations can share experiences, lessons learned, and best practices in identifying and preventing natural hazard risks.

Coordination and Collaboration:

a. Interagency Cooperation: The UN promotes interagency cooperation and coordination in addressing natural hazard risks. It brings together different UN agencies, programs, and specialized bodies to pool resources, expertise, and knowledge for a comprehensive and coordinated approach.

b. Partnerships with NGOs and Civil Society: The UN collaborates with NGOs and civil society organizations in identifying and preventing natural hazard risks. It recognizes the importance of their local knowledge, community engagement, and grassroots efforts in risk reduction. Partnerships with NGOs and civil society enable the UN to leverage their expertise, mobilize resources, and ensure the inclusion of diverse perspectives in decision-making processes.

c. Regional and International Cooperation: The UN facilitates regional and international cooperation in addressing natural hazard risks. It supports regional initiatives, platforms, and networks that promote collaboration, knowledge sharing, and resource mobilization among member states and stakeholders.

Humanitarian Response and Recovery:

a. Emergency Response: The UN and its humanitarian agencies, such as the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), play a crucial role in coordinating and providing emergency response to large-scale natural hazard events. They mobilize resources, coordinate relief efforts, and support affected populations with essential services, including shelter, food, water, and healthcare.

b. Post-Disaster Recovery: The UN assists member states in post-disaster recovery and reconstruction. It supports efforts to build back better and more resilient communities, infrastructure, and ecosystems.

This includes providing technical expertise, financial resources, and policy guidance for long-term recovery planning and implementation.

Early Warning Systems and Preparedness:

a. UN Coordination: The UN plays a key role in coordinating the development and improvement of early warning systems for natural hazards. It facilitates the collaboration between member states, technical agencies, and relevant stakeholders to enhance the effectiveness of early warning systems worldwide.

b. NGOs and Civil Society Engagement: NGOs and civil society organizations affiliated with the UN contribute to early warning systems by raising awareness among local communities, disseminating information, and promoting preparedness measures.

They often work closely with vulnerable communities to ensure that early warning messages reach those at risk.

Risk Communication and Community Engagement:

a. **UN Guidelines:** The UN provides guidelines and support for risk communication strategies, promoting effective communication of natural hazard risks to communities. These guidelines emphasize the importance of engaging with local communities, ensuring the delivery of clear and actionable messages, and fostering trust and understanding.

b. **NGO and Civil Society Initiatives:** NGOs and civil society organizations affiliated with the UN play a crucial role in community engagement and risk communication.

They facilitate dialogues, conduct awareness campaigns, and involve communities in decision-making processes related to natural hazard risks. Their local presence and grassroots connections enable them to effectively reach and engage with at-risk communities.

Financing and Resource Mobilization:

a. **UN Funding Mechanisms:** The UN supports financing mechanisms and initiatives to mobilize resources for addressing natural hazard risks. This includes the establishment of funds, such as the UN Central Emergency Response Fund (CERF), which provide rapid and predictable funding for emergency response efforts.

b. **NGO and Civil Society Advocacy:** NGOs and civil society organizations affiliated with the UN often advocate for increased funding and resource allocation towards risk reduction and prevention. They engage with governments, international organizations, and private sector entities to mobilize financial resources and support for initiatives aimed at reducing natural hazard risks.

Research and Innovation:

a. UN Research Initiatives: The UN promotes research on natural hazards, risk assessment methodologies, and innovative solutions for risk reduction. It supports scientific studies, knowledge sharing, and the development of evidence-based policies and practices.

b. NGO and Civil Society Contributions: NGOs and civil society organizations affiliated with the UN contribute to research and innovation by conducting field studies, documenting local knowledge, and developing community-driven solutions.

They often engage in participatory research approaches that involve local communities in identifying and addressing natural hazard risks.

Advocacy for Policy Integration:

a. UN Policy Integration: The UN advocates for the integration of risk reduction and prevention considerations into various policy domains. This includes advocating for the incorporation of risk reduction measures in development planning, climate change adaptation strategies, urban planning, and infrastructure development.

b. NGO and Civil Society Influence: NGOs and civil society organizations affiliated with the UN play a crucial role in influencing policy integration at local, national, and international levels. Through their advocacy efforts, they raise awareness about the need to address natural hazard risks and advocate for policy changes that prioritize risk reduction and prevention.

Knowledge Sharing and Capacity Development:

a. UN Platforms and Networks: The UN facilitates platforms and networks for knowledge sharing and capacity development in the field of natural hazard risk reduction. These platforms bring together experts, policymakers, NGOs, and civil society organizations to share experiences, best practices, and lessons learned.

b. NGO and Civil Society Capacity Building: NGOs and civil society organizations affiliated with the UN engage in capacity-building initiatives at the community level. They provide training, workshops, and educational programs to enhance the knowledge and skills of local communities in identifying, preventing, and responding to natural hazard risks.